

ARJUNA

Test → Complete Mole Concept

JEE

LECTURE - 12

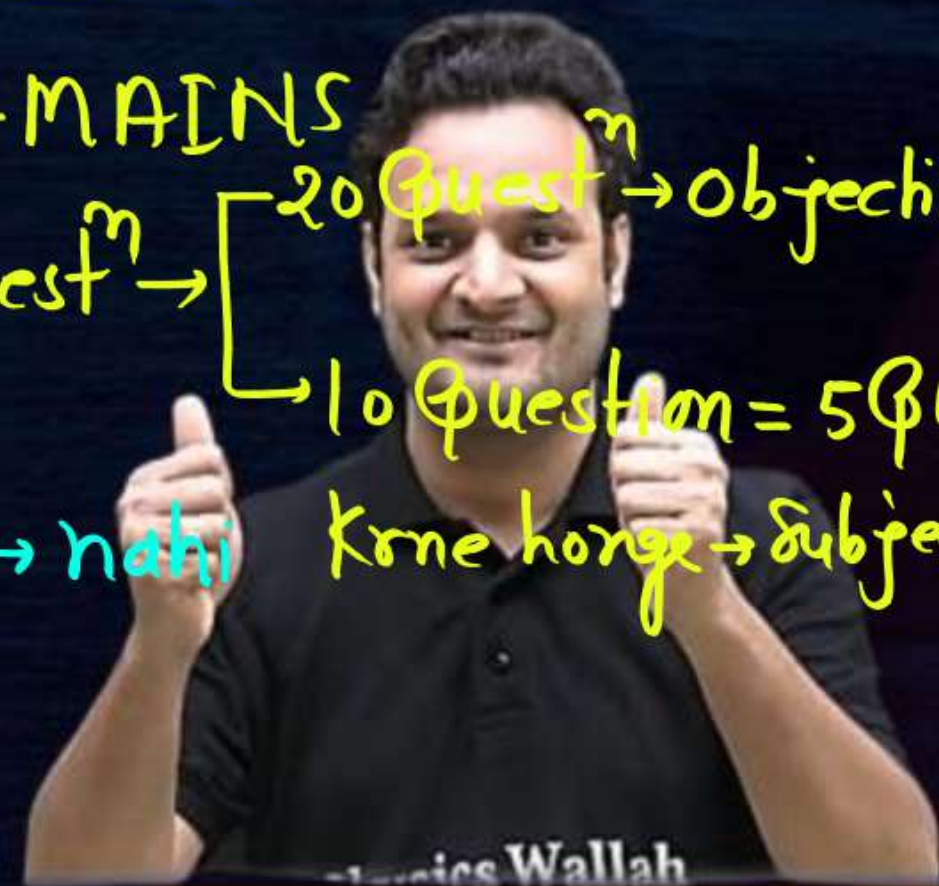
Atomic structure

31 July ⇒ JEE-MAINS

(30 Questⁿ → [20 Questⁿ → Objective
10 Question = 5 Questⁿ

Normality → nahi
ayega

Krne honge → Subjective



Sarvesh sir



TABLE OF CONTENT



01

Hund's rule

02

03

04



Q. Select the subshell which has maximum energy



A

3s

$$3+0=3$$

40 Sec



B

$$4+1=5$$

4p

$$4+0=4$$

4s

C

3d

$$3+2=5$$

D

① $\Rightarrow$ Energy $\propto (n+l)$

$n+l = \text{constant (same)}$

② Energy $\propto n$ (jab 1st Rule na lg paye, then used second rule)



Paulie's exclusion principle

The Pauli exclusion principle states that in a single atom no two electrons will have an identical set or the same quantum numbers (n, l, m_l , and m_s). To put it in simple terms, every electron should have or be in its own unique state (singlet state). There are two salient rules that the Pauli Exclusion Principle follows:

- Only two electrons can occupy the same orbital.
- The two electrons that are present in the same orbital must have opposite spins or they should be antiparallel.

→ Value of 4 Quantum does not same for any two e^-
→ It means two e^- with opposite spin present in orbital



$$E_x \rightarrow C=6 \rightarrow \underline{1s^2}, 2s^2, 2p^2$$

$$\begin{array}{c} \textcircled{1}s \\ | \\ n \\ l=0 \end{array}$$

$$\begin{array}{c} \underline{1s} \\ \boxed{1\downarrow} \\ | \\ \textcircled{1} \end{array}$$

$$\left| \begin{array}{l} n=1 \\ \underline{l=0} \\ m=0 \\ s=+\frac{1}{2} \end{array} \right.$$

$$\begin{array}{c} \underline{2s} \\ \boxed{1\downarrow} \end{array}$$

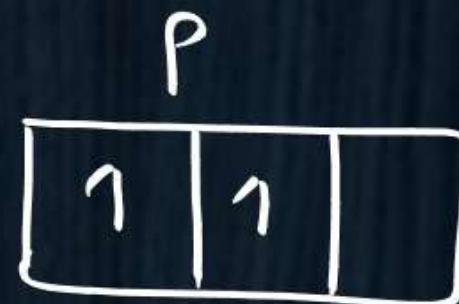
$$\begin{array}{c} \underline{2p} \\ \boxed{\begin{array}{|c|c|c|} \hline \underline{1} & 1 & \\ \hline \end{array}} \\ \begin{array}{ccc} -1 & 0 & +1 \end{array} \\ \textcircled{2} \end{array}$$

$$\begin{array}{l} n=2 \\ l=1 \\ m=-1 \\ s=+\frac{1}{2} \end{array}$$

$$\begin{array}{c} \underline{l=1} \\ \underline{m=-1, 0, +1} \end{array}$$



$E_x \rightarrow C \rightarrow G = 1s^2, 2s^2, 2p^2$



↑↑

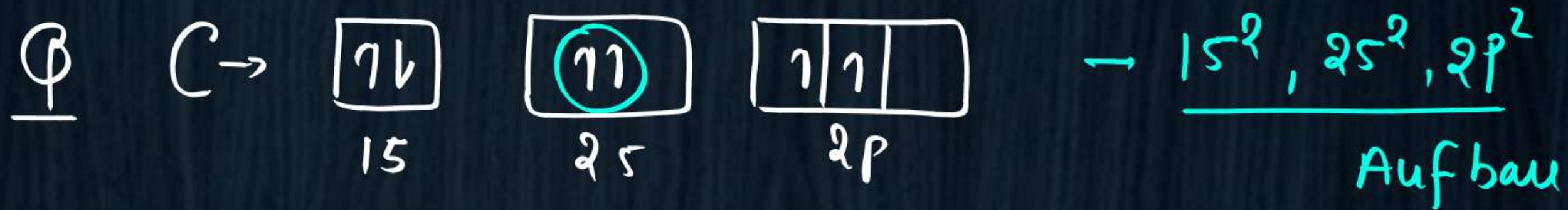
①

②

$n=1$
 $l=0$
 $m=0$
 $s=+\frac{1}{2}$

$n=1$
 $l=0$
 $m=0$
 $s=-\frac{1}{2}$





above arrangement does not follow $C-6 = 1s^2 < 2s^2 < 2p^2$

(a) Aufbau

(b) Pauli's ✓✓

(c) Both

(d) follow Both



Hund's rule

According to Hund's rule:

- Before the double occupation of any orbital, every orbital in the sub level is singly occupied.
- For the maximization of total spin, all electrons in a single occupancy orbital have the same spin.

$3p^4$ -subshell

↑↓	↑	↑
----	---	---

-1 0 +1

$p_x = p_z = p_y = \text{equal energy (degenerate orbital)}$

$3d^7$

↑↓	↑↓	↑	↑	↑
----	----	---	---	---

$d_{xy} \ d_{yz} \ d_{zx} \ d_{z^2} \ d_{x^2-y^2}$



p^3 -subshell

Ex → (a)

↑	↑	↑
---	---	---

✓

(b)

↓	↓	↓
---	---	---

✓

(c)

↑	↑	↓
---	---	---

✗

(d)

↑	↓	↓
---	---	---

✗

p^2 -subshell

↑	↑	
---	---	--

✓

	↑	↑
--	---	---

✓

↑		↑
---	--	---

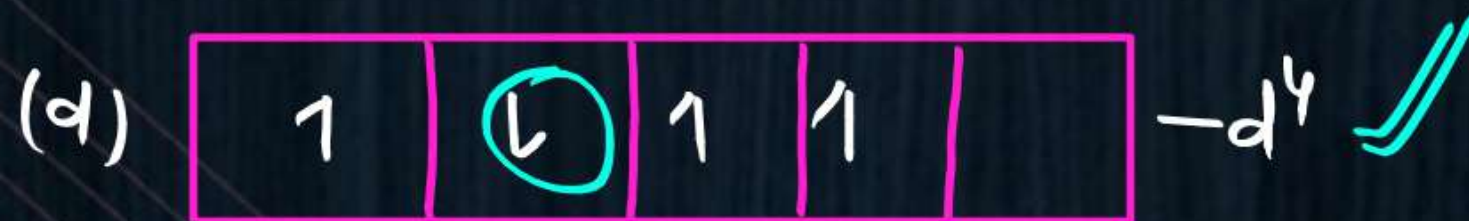
✓

	↓	↓
--	---	---

✓



Q select incorrect arrangement of e^-



$$\underline{C_{SD} = 26}$$

$\Rightarrow$ 4-Quantum No. of any e^- = always follows
2-rule

$$\textcircled{1} \quad n > l$$

$$\textcircled{2} \quad l \geq |m|$$



Q15. Which of the following is not permissible arrangement of electrons in an atom?

(a) $n = \underline{4}, l = \underline{0}, m = \underline{0}, s = -1/2$

(b) $n = \underline{5}, l = \underline{3}, m = 0, s = +1/2$

✓ (c) $n = \underline{3}, l = \underline{2}, m = \underline{-3}, s = -1/2$
 $l < |m|$

(d) $n = 3, l = 2, m = -2, s = -1/2$

① $n > l$

② $l \geq |m|$

Q select correct set of quantum No. of any e^-

(a) $\times$ $n=3$, $l=2$, $m=-3$, $s=+\frac{1}{2}$

① $n > l$

② $l \geq |m|$

(b) $\times$ $n=2$, $l=3$, $m=-3$, $s=+\frac{1}{2}$
 $n < l$

(c) $\times$ $n=3$, $l=3$, $m=-3$, $s=+\frac{1}{2}$
 $n=l$

✓ (d) $n=3$, $l=0$, $m=0$, $s=-\frac{1}{2}$
 $n > l$ $l=m$



NODE. ($\psi=0$)

NODE $\rightarrow$ any region $\rightarrow \psi \rightarrow 0$, $\psi=0 \Rightarrow$ probability of finding of e^- is $\psi \rightarrow \text{zero}$, $\psi=0$



$\psi=0$ (node)
s-orbital

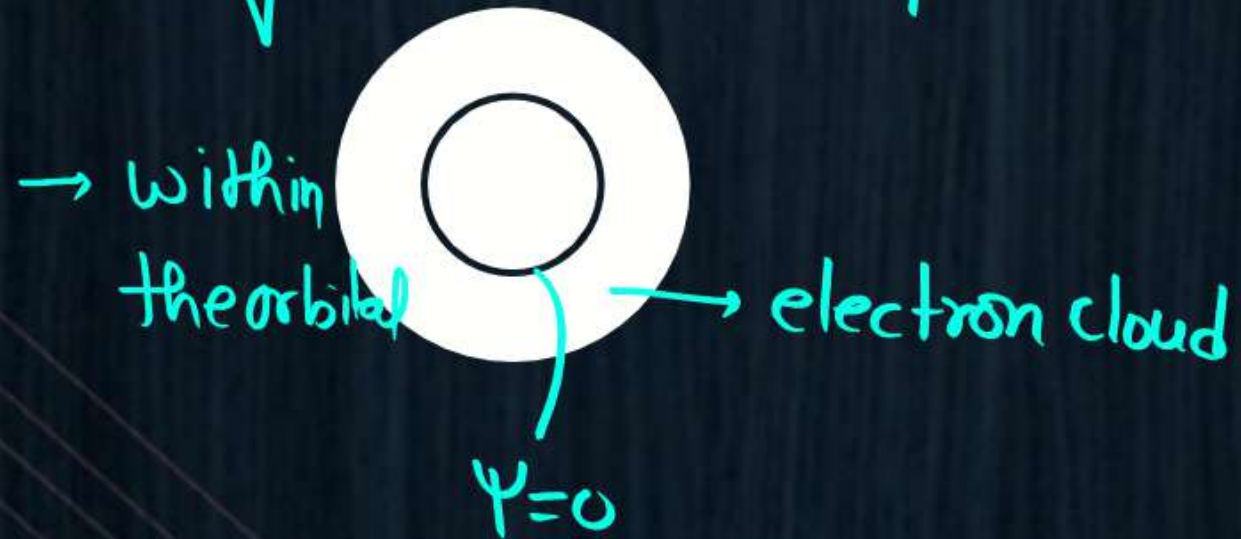


NODE

Radial node

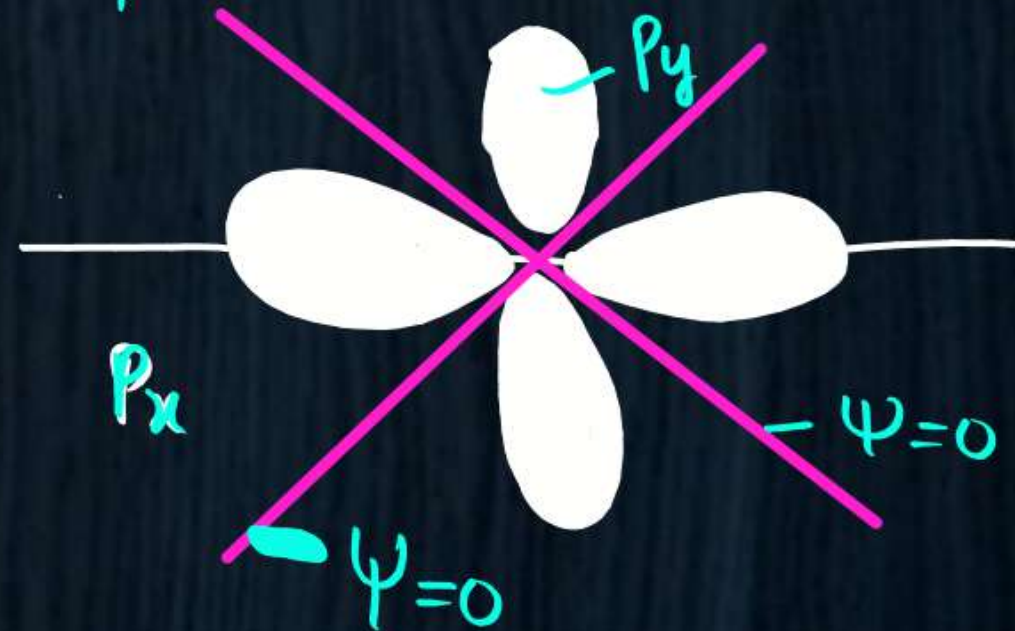
→ Radial node or spherical node

→ No. of radial node = $n - l - 1$



Angular node or planar node

→ form between the orbital



→ total No. of angular node = l



Ex $\rightarrow$ 3s-orbital

No. of Radial node

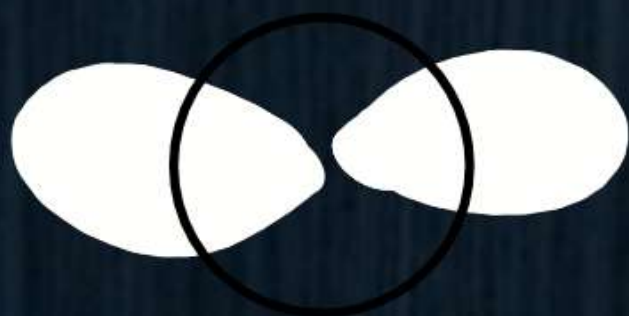
$$= n - l - 1$$

$$= 3 - 0 - 1 = 2$$

Ex $\Rightarrow$ 3p-orbital

No. of Radial node = $n - l - 1$

$$= 3 - 1 - 1 = 1$$



p-orbital

Ex $\rightarrow$ 3s-orbital

angular node = $l = 0$

Ex $\rightarrow$ 3p-orbital

Angular node = $l = 1$

Ex $\rightarrow$ 4d-orbital

Angular node = $l = 2$



$$\underline{C_{SD}} = 27$$

$$\text{Radial node} = n - l - 1$$

$$\text{angular node} = l$$

$$\text{total node} = n - l - 1 + l = \underline{\underline{n - 1}}$$



	<u>Orbital</u>	Radial node $n-l-1$	Angular node (l)	total node $n-1$
(1)	1s →	$1-0-1 = 0$	$l=0$	0
(2)	<u>2s</u> →	$2-0-1 = 1$	$l=0$	1
(3)	2 <u>p</u> →	$2-1-1 = 0$	$l=1$	1
(4)	3s →	$3-0-1 = 2$	$l=0$	2
(5)	3 <u>p</u> →	$3-1-1 = 1$	$l=1$	2
(6)	3d →	$3-2-1 = 0$	$l=2$	2



47. The number of nodal planes in a P_x orbital is

(2001 1M)

↓
angular node = $l = 1$

a.

One //

b.

Two

c.

three

d.

zero

Q select the orbital, which has zero radial node

$$n-l-1$$

$$s \rightarrow l=0$$

$$p \rightarrow l=1$$

$$d \rightarrow l=2$$

$$f \rightarrow l=3$$

$$(a) \quad \underline{2s} \rightarrow 2-0-1=1$$

$$(b) \quad 4p \rightarrow 4-1-1=2$$

$$(c) \quad 4d \rightarrow 4-2-1=1$$

$$\checkmark (d) \quad 4f \rightarrow 4-3-1=0$$



Shape of orbital

s-orbital =



p-orbital —

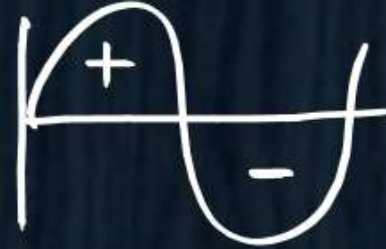
$p_x =$



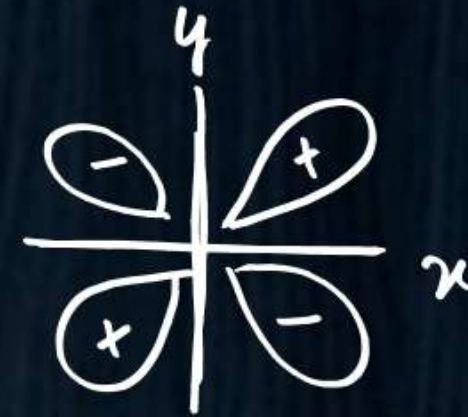
$p_y =$



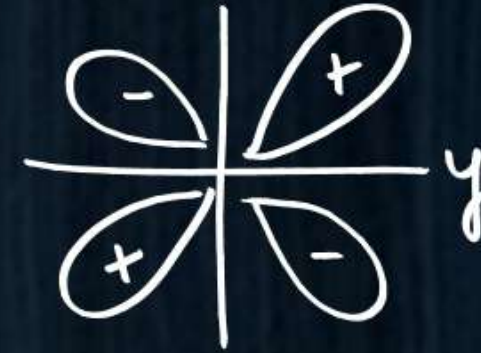
$p_z =$



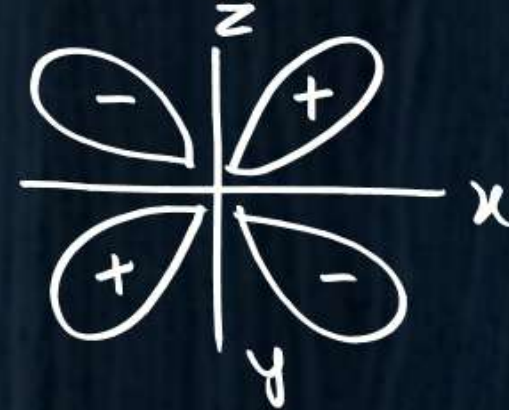
$d_{xy} =$



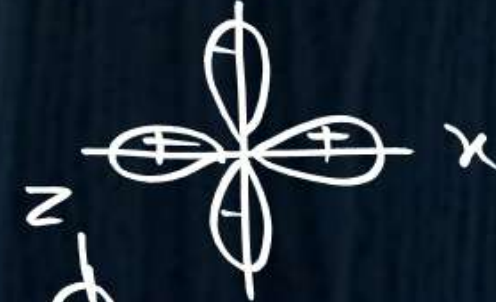
$d_{yz} =$



$d_{zx} =$

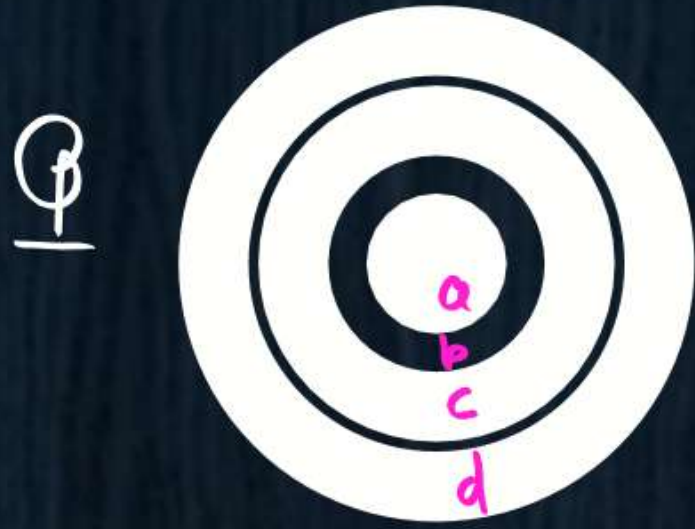


$d_{x^2-y^2} =$



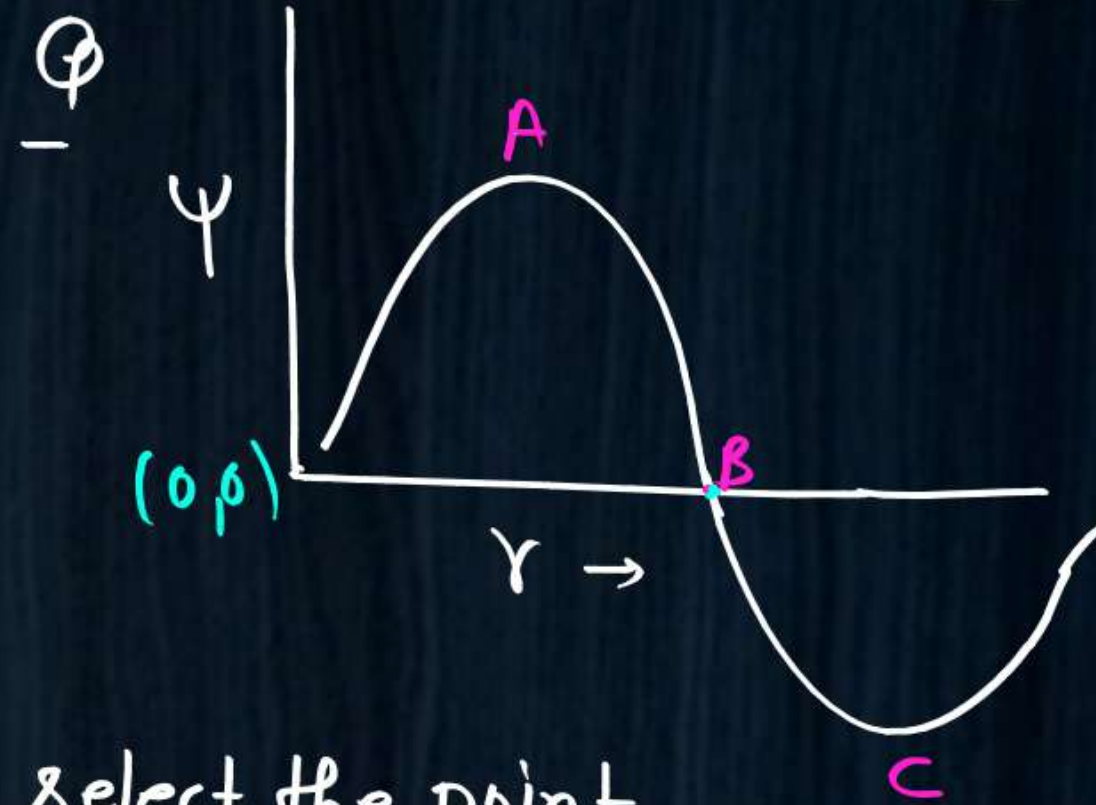
$d_{z^2} =$





select the correct region, in which
tendency to finding of e^- cloud is zero ($\psi=0$)
or node

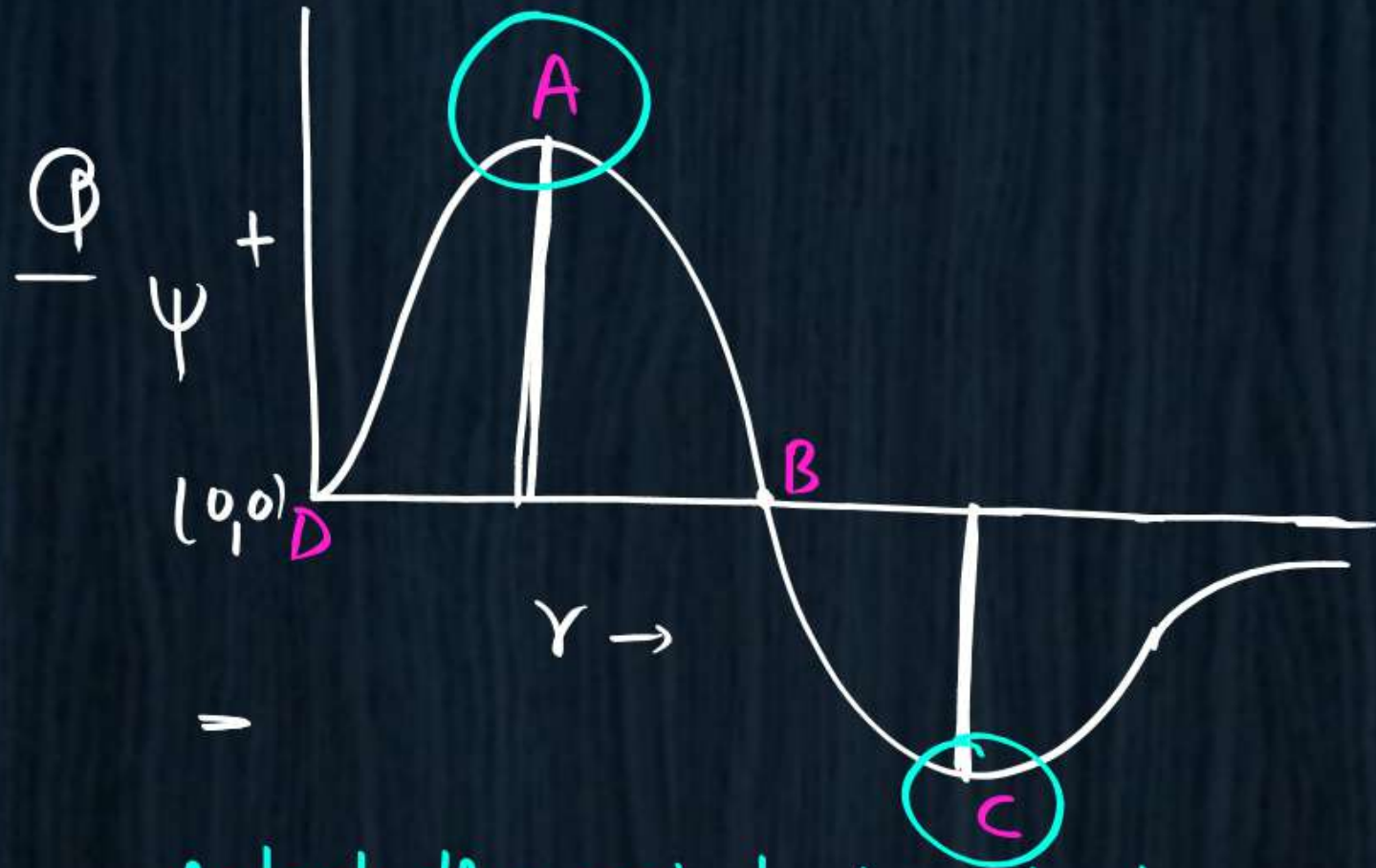
- (a) a
- (b) b ✓✓
- (c) d
- (d) None of these



select the point
at $\psi=0$

- (a) a
- (b) B ✓✓
- (c) c
- (d) all point





Select the point, in which max. e^- cloud
present

(a) A, B

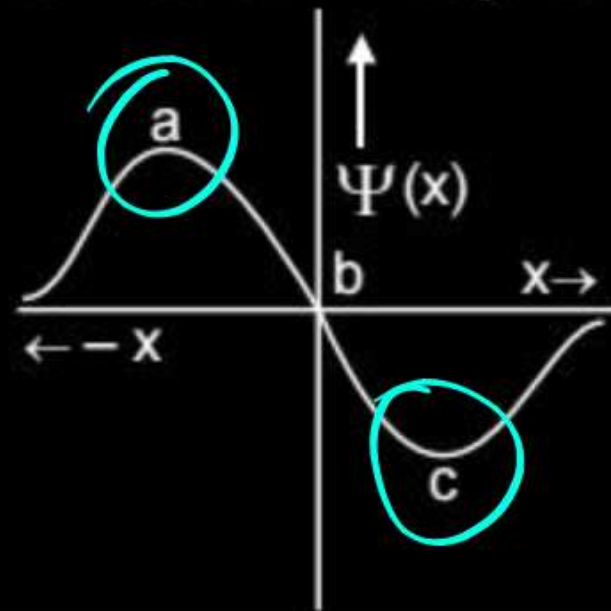
(b) A, C ✓✓

(c) C

(d) D



26. The electrons are more likely to be found (2019 Main, 12 April I)



☒ a. in the region a and c

☐ b. in the region a and b

☐ c. only in the region a

☐ d. only in the region c

Home work

DPP No = 9, 10



Thank - You

